US009343245B2

(12) **United States Patent**
Oh

(10) **Patent No.: US 9,343,245 B2**
(45) **Date of Patent: May 17, 2016**

(54) **MOLDED CASE CIRCUIT BREAKER**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/446,099**

(22) Filed: **Jul. 29, 2014**

(65) **Prior Publication Data**

US 2015/0129400 A1 May 14, 2015

(30) **Foreign Application Priority Data**

Nov. 8, 2013 (KR) 10-2013-0135793

(51) **Int. Cl.**

H01H 1/64	(2006.01)
H01H 9/02	(2006.01)
H01H 71/08	(2006.01)
H01H 3/22	(2006.01)

(52) **U.S. Cl.**

CPC . ***H01H 9/02*** (2013.01); ***H01H 3/22*** (2013.01); ***H01H 9/0264*** (2013.01); ***H01H 71/08*** (2013.01)

(58) **Field of Classification Search**

CPC H01H 9/02; H01H 71/08; H01R 9/2408; H01R 9/2416

USPC 200/293, 303; 335/202; 439/717

See application file for complete search history.

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(57) **ABSTRACT**

A molded case circuit breaker, includes: a case; a power side terminal portion and a load side terminal portion formed at two sides of the case; a mounter installed at the terminal portion with a structure to enclose a terminal connector connected to the terminal portion, wherein the mounter includes: a mounting surface for mounting the terminal connector; insulation surfaces extending from two side edges of the mounting surface, and spaced from each other; and a cover surface having an opening, and formed on outer side surfaces of the insulation surfaces so as to cross the insulation surfaces and the mounting surface. Under such configuration, a regulated insulation distance can be obtained, and the terminal connector can be supported more stably.

11 Claims, 9 Drawing Sheets

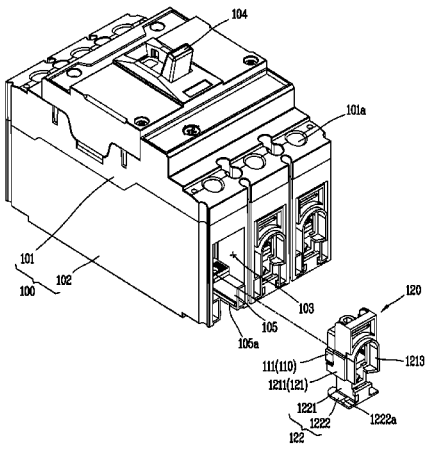


FIG. 1
PRIOR ART

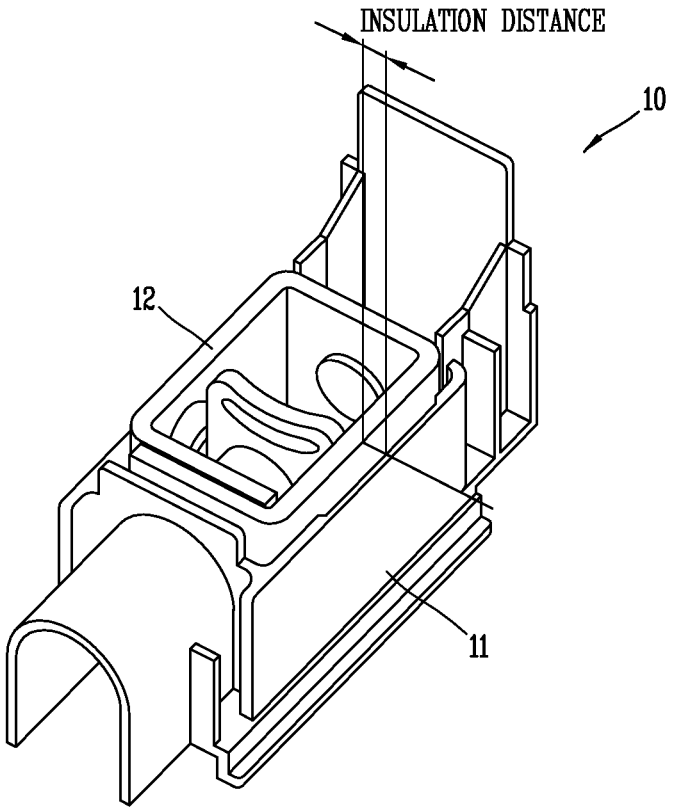


FIG. 2

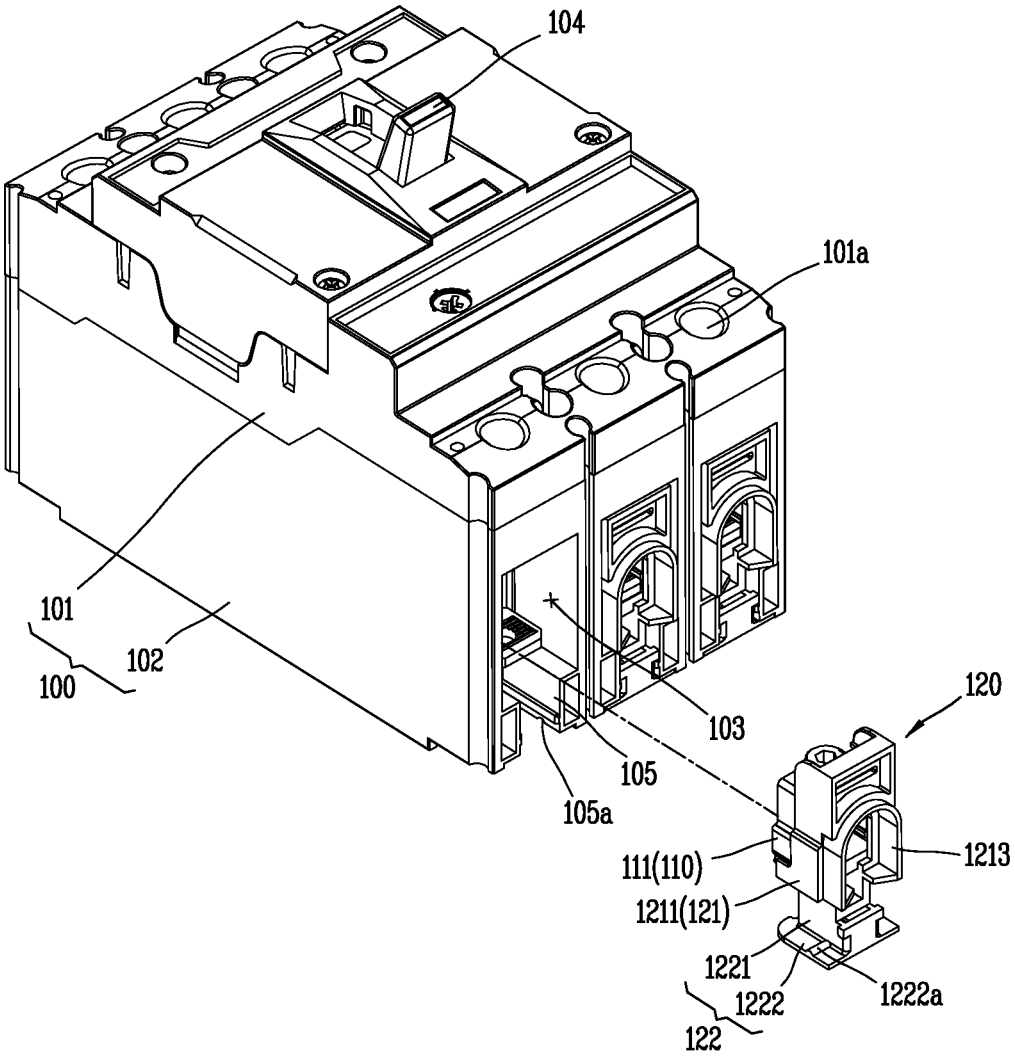

104
101a
101
102
100
103
105
105a
120
111(110)
1213
1211(121)
1221
1222
1222a
122

FIG. 3

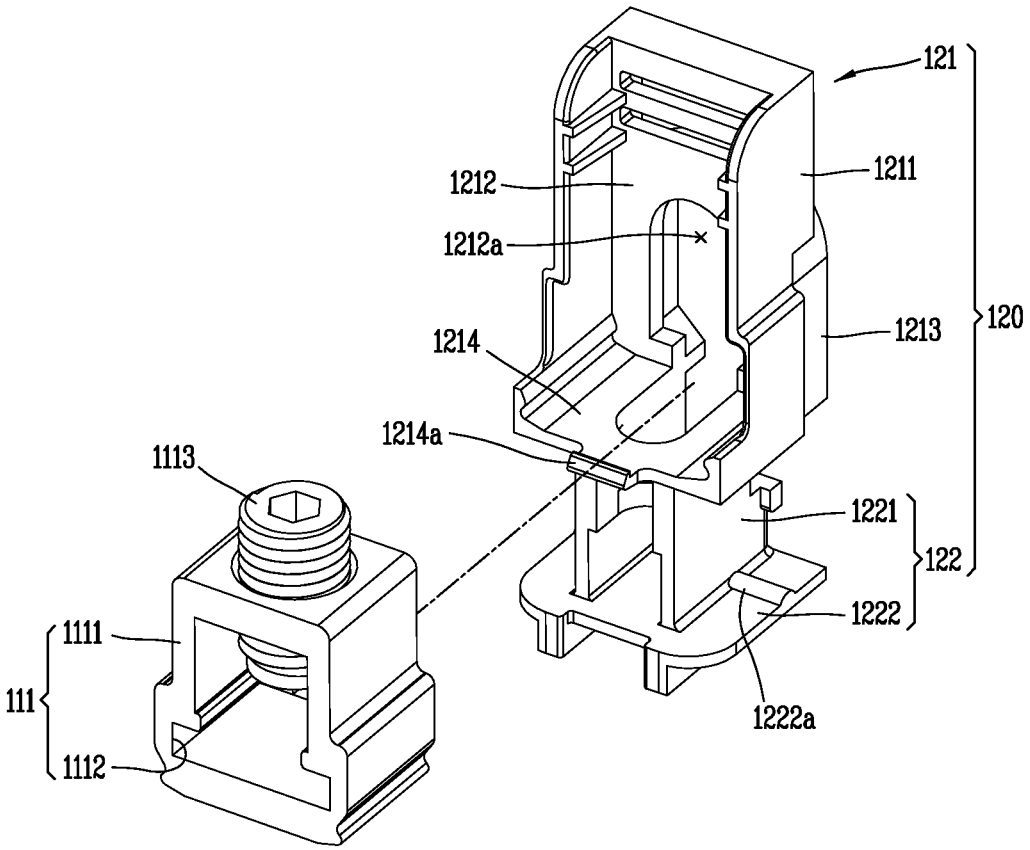

121
1211
1212
1212a
1213
120
1214
1214a
1113
1221
122
1222
1111
111
1112
1222a

FIG. 4

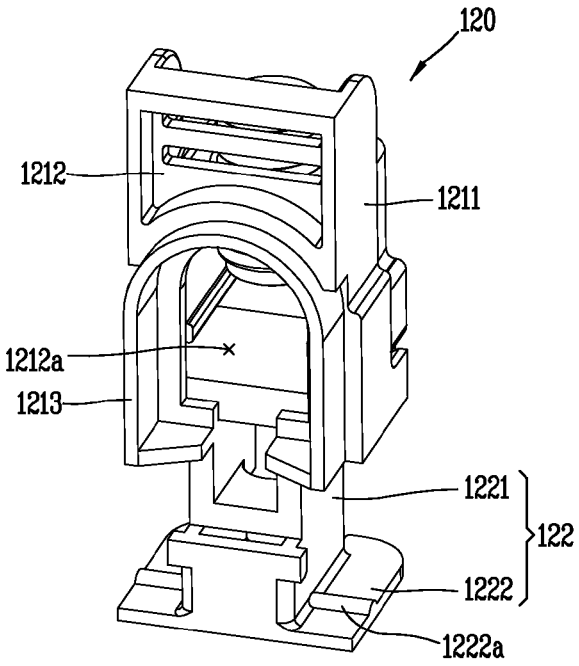

120
1212
1211
1212a
1213
1221
122
1222
1222a

FIG. 5

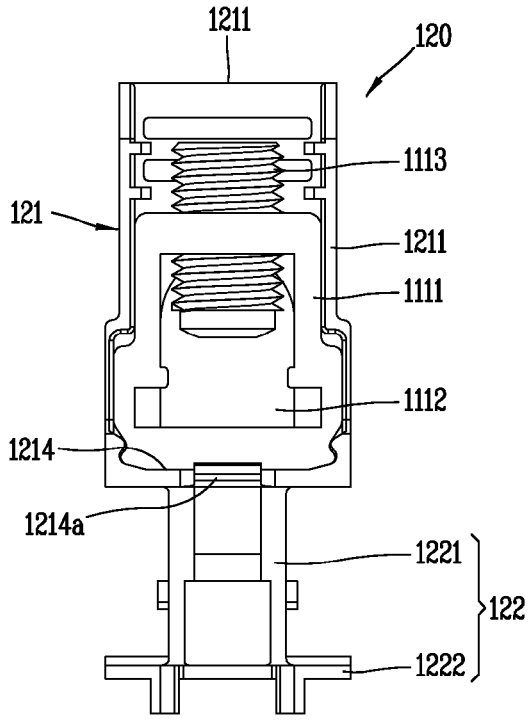

1211
120
1113
121
1211
1111
1112
1214
1214a
1221
122
1222

FIG. 6

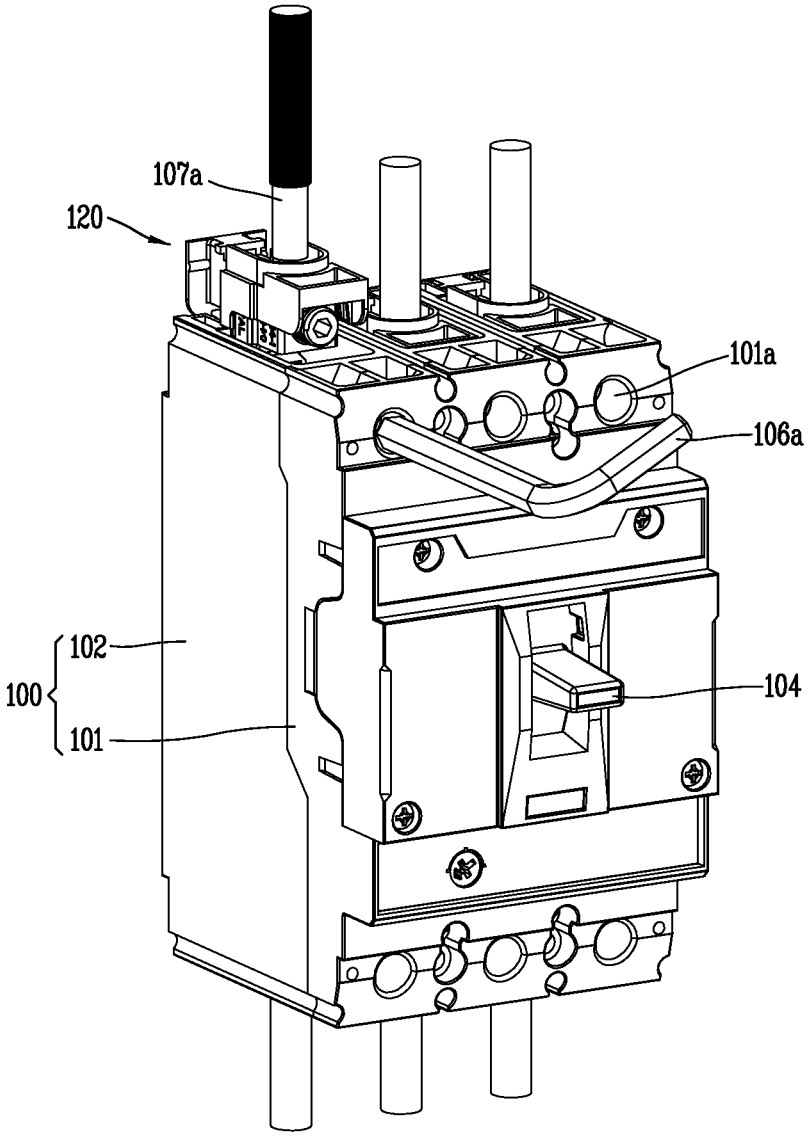


FIG. 7

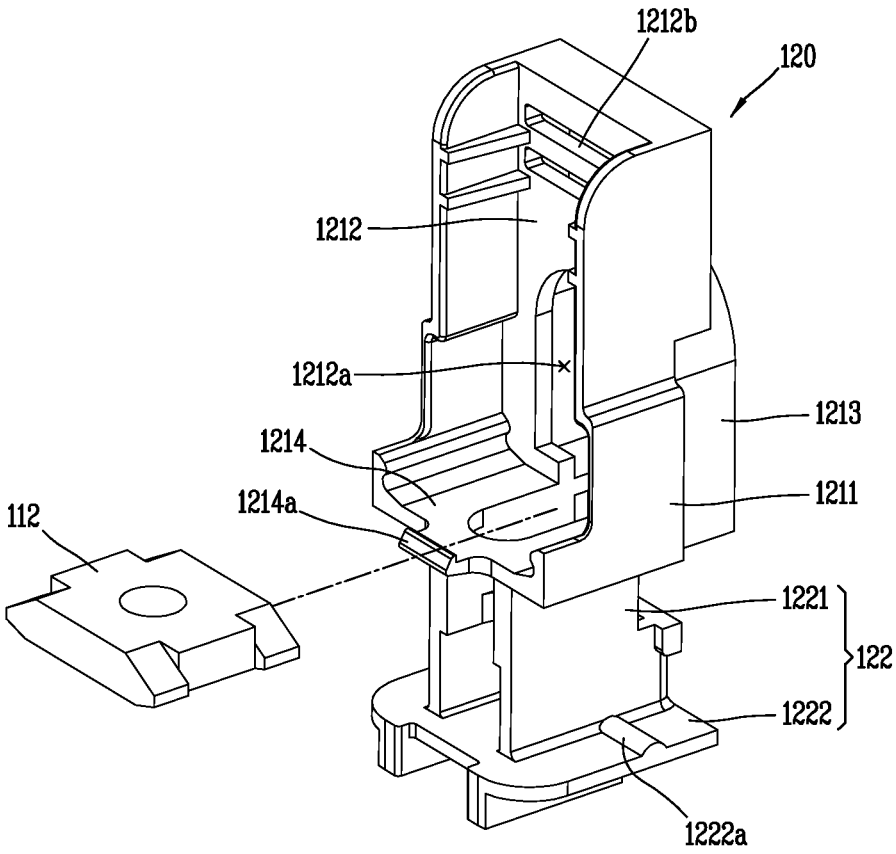

1212b
120
1212
1212a
1213
1214
1211
1214a
112
1221
122
1222
1222a

FIG. 8

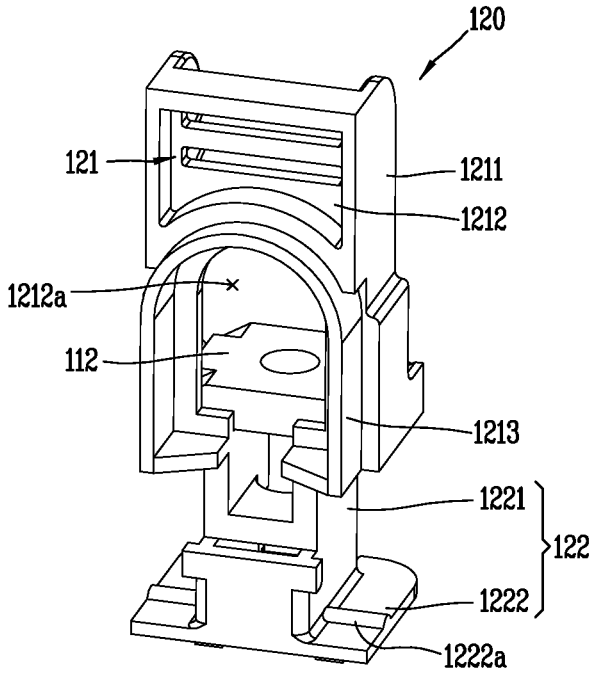

120
121
1211
1212
1212a
112
1213
1221
122
1222
1222a

FIG. 9

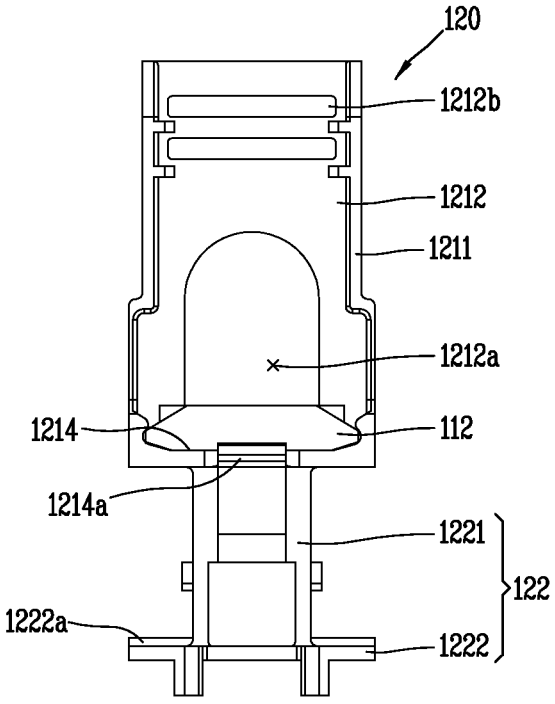

120
1212b
1212
1211
1212a
1214
112
1214a
1221
122
1222a
1222

FIG. 10

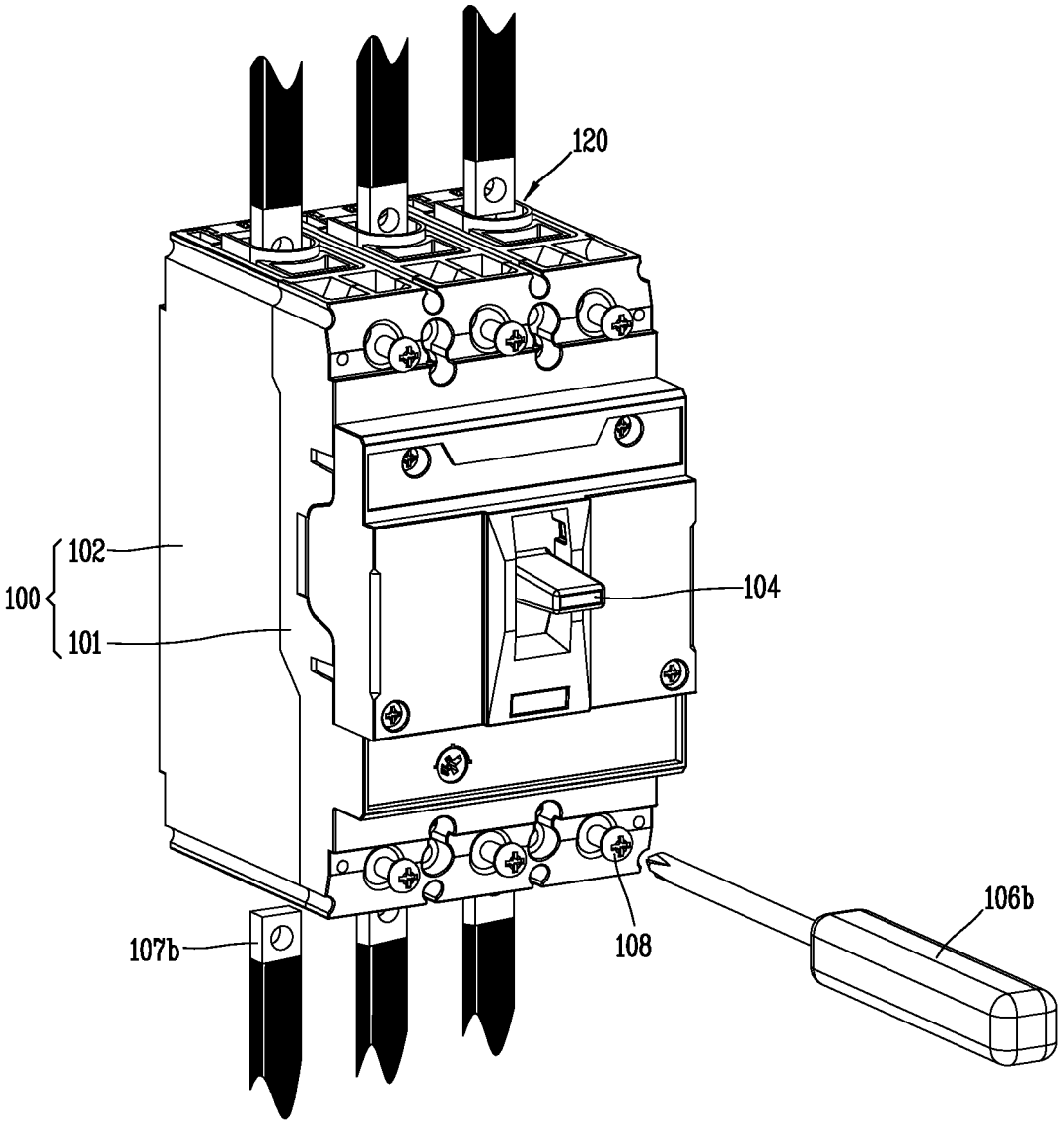
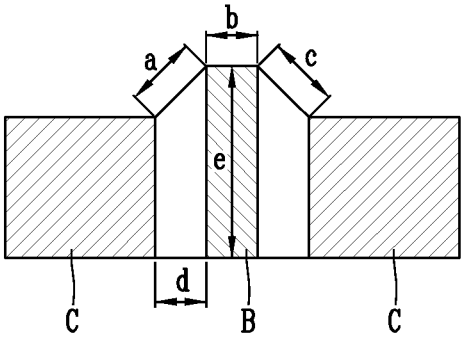


FIG. 11



SPATIAL DISTANCE = a + b + c
CREEPAGE DISTANCE = 2d + 2e + b

MOLDED CASE CIRCUIT BREAKER

CROSS-REFERENCE TO RELATED APPLICATION

Pursuant to 35 U.S.C. §119(a), this application claims the benefit of earlier filing date and right of priority to Korean Application No. 10-2013-0135793, filed on Nov. 8, 2013, the contents of which are all hereby incorporated by reference herein in its entirety.

BACKGROUND OF THE DISCLOSURE

1. Field of the Disclosure

The present disclosure relates to a molded case circuit breaker, and particularly, to a molded case circuit breaker capable of fixing a terminal connector thereto with various structures, while obtaining a phase-to-phase insulation distance and a phase-to-ground insulation distance.

2. Background of the Disclosure

Generally, when a molded case circuit breaker performs a trip operation for interrupting a fault current, arc gas of a plasma form occurs in the molded case circuit breaker with electric energy of a high temperature and a high pressure.

In this case, if insulation between different phases, or between the molded case circuit breaker and the ground is insufficient, an electrical contact occurs therebetween, by the arc gas leaked to outside from the molded case circuit breaker. This may cause a secondary short circuit.

In order to solve such problem, the molded case circuit breaker should obtain set phase-to-phase and phase-to-ground insulation distances of a current carrying part.

FIG. **1** is a perspective view illustrating a terminal barrier system of a molded case circuit breaker which has been disclosed in the following cited reference document D1 (U.S. Pat. No. 6,172,586 B1) in accordance with the prior art.

Referring to FIG. **1**, the terminal barrier system **10** is installed at a power side and a load side of a case, for each phase. The terminal barrier system **10** obtains a phase-to-phase insulation distance by forming a predetermined interval (space) between a side wall of a lug **12** and a side wall of a mold **11**, the lug for connecting an external terminal thereto using a mounting rib formed on an inner side surface of the mold **11** (barrier body).

In the cited reference D1, an insulation distance is increased by obtaining a space, by spacing the mold **11** and a connector (lug **12** or the terminal plate) from each other. Only part of the mold **11** may come in contact with the connector, for a maximized insulation distance.

However, a barrier system, capable of obtaining an insulation distance in a different manner from the conventional barrier system of a molded case circuit breaker, has been required.

SUMMARY OF THE DISCLOSURE

Therefore, an aspect of the detailed description is to provide a molded case circuit breaker capable of satisfying a standard, by obtaining phase-to-phase and phase-to-ground insulation distances with a new structure differentiated from the conventional one.

Another aspect of the detailed description is to provide a molded case circuit breaker capable of stably supporting a terminal connector in a various manner.

To achieve these and other advantages and in accordance with the purpose of this specification, as embodied and broadly described herein, there is provided a molded case circuit breaker, including: a case; a power side terminal portion; a load side terminal portion; and a mounter. The power side terminal portion and the load side terminal portion may be formed at two sides of the case. The mounter may be installed at the terminal portion with a structure to enclose a terminal connector connected to the terminal portion. The mounter includes a mounting surface for mounting the terminal connector; insulation surfaces extending from two side edges of the mounting surface, and spaced from ach other; and a cover surface having an opening, and formed on outer side surfaces of the insulation surfaces so as to cross the insulation surfaces and the mounting surface.

In an aspect of the present invention, an insulation distance can be obtained by using an insulation distance extension portion of a new structure, rather than by using an interval (spatial distance) between a lug, a terminal connector and a terminal plate.

The mounter may be provided with an insulation distance extension portion extending from the cover surface in parallel to the insulation surface.

The insulation distance extension portion may be protruding along an edge of the opening.

The terminal connector may include: a lug having a box structure, and provided with a cavity therein such that an external terminal is inserted thereinto; and a coupling member inserted to one surface of the lug, and configured to fix the external terminal, wherein the insulation surfaces are formed to contact two side surfaces of the lug.

The lug may be provided with an external terminal fitting portion having a structure to enclose the external terminal.

The terminal connector may be a terminal plate having a coupling hole therein, and having a plate structure. The terminal plate may come in contact with the mounting surface.

The mounter may include a recess portion concaved from the cover surface toward inside of the insulation surface; and slits penetratingly-formed at the recess portion.

The mounter may include a shielding unit extending from the mounting surface toward a rear surface of the case, and configured to obtain a phase-to-ground insulation distance.

The shielding unit may include a mounting surface connection portion vertically extending from the mounting surface toward a rear surface of the case; and a supporting portion spaced from the mounting surface, and configured to support the mounting surface connection portion.

The mounter may be detachably assembled into the terminal portion provided in the form of an insertion recess.

The mounting surface may be provided with a separation prevention member having a locking protrusion at one end thereof. One side of the terminal connector may be fixed to the mounting surface by being locked by the locking protrusion.

In the molded case circuit breaker according to the present invention, the terminal connector can be supported more stably, while obtaining a set insulation distance.

Further scope of applicability of the present application will become more apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the disclosure, are given by way of illustration only, since various changes and modifications within the spirit and scope of the disclosure will become apparent to those skilled in the art from the detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the disclosure and are incor-

porated in and constitute a part of this specification, illustrate exemplary embodiments and together with the description serve to explain the principles of the disclosure.

In the drawings:

FIG. **1** is a perspective view illustrating a terminal barrier system of a molded case circuit breaker which has been disclosed in the following cited reference document D1 in accordance with the prior art;

FIG. **2** is a perspective view of a molded case circuit breaker according to an embodiment of the present invention;

FIG. **3** is a perspective view illustrating a state where a lug has been mounted to an inner side of a mounter, and an exploded view thereof;

FIG. **4** is a rear perspective view of the mounter of FIG. **3**, which was seen from outside;

FIG. **5** is a frontal view of FIG. **3**;

FIG. **6** is a perspective view illustrating a state where a circular external terminal has been assembled into a mounter of the present invention;

FIG. **7** is a perspective view illustrating a state where a terminal plate has been mounted to inside of a mounter, and an exploded view thereof;

FIG. **8** is a rear perspective view of the mounter of FIG. **7**, which was seen from outside;

FIG. **9** is a frontal view of FIG. **7**;

FIG. **10** is a perspective view illustrating a state where a plate-type external terminal has been assembled into a mounter of the present invention; and

FIG. **11** is a schematic diagram for explaining a term of 'insulation distance' between a terminal connector and a barrier according to the present invention.

DETAILED DESCRIPTION OF THE DISCLOSURE

Description will now be given in detail of the exemplary embodiments, with reference to the accompanying drawings. For the sake of brief description with reference to the drawings, the same or equivalent components will be provided with the same reference numbers, and description thereof will not be repeated.

FIG. **2** is a perspective view of a molded case circuit breaker according to an embodiment of the present invention. FIG. **3** is a perspective view illustrating a state where a lug has been mounted to an inner side of a mounter, and an exploded view thereof. FIG. **4** is a rear perspective view of the mounter of FIG. **3**, which was seen from outside. FIG. **5** is a frontal view of FIG. **3**. FIG. **6** is a perspective view illustrating a state where a circular external terminal has been assembled into a mounter of the present invention. FIG. **7** is a perspective view illustrating a state where a terminal plate has been mounted to inside of a mounter, and an exploded view thereof. FIG. **8** is a rear perspective view of the mounter of FIG. **7**, which was seen from outside. FIG. **9** is a frontal view of FIG. **7**. FIG. **10** is a perspective view illustrating a state where a plate-type external terminal has been assembled into a mounter of the present invention; and

The present invention relates to a molded case circuit breaker capable of obtaining a regulated insulation distance and capable of stably supporting a terminal connector **110**.

Referring to FIGS. **2** to **5**, the molded case circuit breaker according to the present invention includes a case **100**, a power side terminal portion and a load side terminal portion **103**, and a mounter **120**. The present invention provides a new type of terminal portion insulating structure capable of insulating arc gas in the terminal portion **103**. Such structure is provided to prevent arc gas generated from inside of the case **100** when contacts are separated from each other, from serving as a bridge for connecting current carrying parts of different phases to each other.

The case **100** includes a base **102** and a cover **101**, and the base **102** and the cover **101** are detachably coupled to each other by a coupling means such as a snap fit.

A manual handle **104** is rotatably mounted to the cover **101**. As a user rotates the manual handle **104**, a fixed contact and a movable contact can be turned on/off.

The base **102** includes therein a contact unit consisting of a movable contactor and a fixed contactor configured to contact or be separated from each other; a switching mechanism configured to contact the movable contactor to the fixed contactor, or to separate the movable contactor from the fixed contactor; a trip unit connected to the switching mechanism and configured to interrupt a power of a main circuit when an abnormal current occurs; and an extinguishing unit configured to extinguish an arc generated when the movable contactor is separated from the fixed contactor.

The contact unit, the switching mechanism, the trip unit, the extinguishing unit may be used as basic components of a circuit breaker by those skilled in the art, and may be modified to have various forms and structures. A configuration and an operation thereof have been already well-known to the public, and thus its detailed explanations will be omitted.

The power side terminal portion and the load side terminal portion **103** are provided at two ends of the case **100**.

The power side terminal portion and the load side terminal portion **103** are formed in parallel for each phase in the form of insertion recesses.

A vent chute **105** is provided at a lower end of the insertion recess (rear side of the base **102**) for each phase, so that arc gas generated from the extinguishing unit can be exhausted to outside through the vent chute **105**.

Coupling holes **101***a* are formed at two ends of the cover **101** for each phase. A coupling member **108** such as a screw may be inserted into the insertion recess of the base **102**, through the coupling hole **101***a*. A tool, such as a driver **106***b* (refer to FIG. **10**) or a hexagonal wrench **106***a* (refer to FIG. **6**), may be partially inserted into the coupling hole **101***a*. The coupling member **108** serves to fix the terminal connector **110** to the mounter **120**.

The terminal connector **110** may be inserted into the terminal portion **103** of the case **100** by the mounter **120**, thereby connecting an external terminal **107***a*, **107***b* to a terminal of the molded case circuit breaker. The terminal connector **110** may include a lug **111** or a terminal plate **112**.

The lug **111** may have a box-shaped structure of a closed sectional surface. The lug **111** is open in back and forth directions (insertion direction), and is provided with a cavity therein. Under such configuration, the external terminal **107***a*, **107***b* can be inserted into the cavity.

The lug **111** includes a lug body **1111**, an external terminal fitting portion **1112** formed at one side of the lug body **1111** and having a flat C-shaped section, and a coupling hole formed at another side of the lug body **1111**.

The external terminal fitting portion **1112** constitutes the lug body **1111**, and the plate-type external terminal **107***b* may be fitted into the external terminal fitting portion **1112** with a width greater than that of the rest lug body **1111**.

As a female screw recess is formed around the coupling hole of the lug body **1111**, a coupling member **1113** may be coupled to the coupling hole.

The coupling member **1113** serves to fix the external terminal **107***a*, **107***b* to the lug **111**. As a male screw thread is formed on an outer side surface of the coupling member **1113**, the coupling member **1113** may be coupled to the lug **111**

through the coupling hole. A hexagonal recess is formed in an upper end of the coupling member **1113**, so that a user can rotate the coupling member **1113** right and left using a hexagonal wrench.

If the coupling member **1113** is rotated in one direction, it is inserted into the lug **111** along a coupling direction (**111**). As a result, the coupling member **1113** fixes the external terminal **107***a*, **107***b* to the lug **111** in a pressing manner. On the other hand, if the coupling member **1113** is rotated in another direction, it is separated from the lug **111**. As a result, the pressure applied to the external terminal **107***a*, **107***b* is released.

Referring to FIGS. **7** to **9**, the terminal plate **112** has a quadrangular plate structure having a coupling hole therein.

In a case where the external terminal **107***a* has a circular sectional surface, it is preferable to use the lug **111**. On the other hand, in a case where the external terminal **107***b* has a plate shape, it is preferable to use the terminal plate **112**.

A through hole is formed at the plate-type external terminal **107***b*. The plate-type external terminal **107***b* is laminated on the terminal plate **112**, and then the terminal plate **112** and the external terminal **107***b* are coupled to each other by a coupling member **108** such as bolts.

The present invention provides the mounter **120** inserted into the terminal portion **103** of the molded case circuit breaker. The mounter **120** serves to mount the terminal connector **110** to the terminal portion **103** configured in the form of an insertion recess.

The mounter **120** is composed of a mounter body **121** for insulating the terminal connectors **110** of different phases from each other, and a shielding unit **122** for insulating the terminal connector and the earth from each other.

The mounter body **121** and the shielding unit **122** may be integrally formed.

The mounter body **121** may be formed to enclose the terminal connector **110**. The mounter body **121** may include a mounting surface **1214** for mounting the terminal connector **110**; insulation surfaces **1211** extending from two side edges of the mounting surface **1214**, and spaced from ach other; and a cover surface **1212** formed to cross the mounting surface **1214** and the insulation surfaces **1211**.

The mounting surface **1214** is a surface parallel to a rear surface of the case **100**, and the insulation surfaces **1211** are surfaces parallel to two side surfaces of the case **100**. And the cover surface **1212** is a surface crossing the mounting surface **1214** and the insulation surfaces **1211**.

The mounting surface **1214** includes a separation prevention member **1214***a* protruding from one end of the mounting surface **1214**. The separation prevention member **1214***a* is provided with a locking protrusion at an end thereof, and is elastically supported at the mounting surface **1214**. As one end of the lug **111** is fittedly-coupled to the mounting surface **1214** by being locked by the locking protrusion, the lug **111** is prevented from being separated from the mounting surface **1214**.

In case of using the terminal plate **112** as the terminal connector **110**, one surface of the terminal plate **112** is fixed to the mounting surface **1214**, and another surface of the terminal plate **112** is fixed to the plate-type external terminal **107***b*.

The insulation surfaces **1211** may be formed on two side surfaces of the lug **111**, thereby reducing the length of the mounter **120** in a width direction.

The cover surface **1212** is disposed on outer side surfaces of the insulation surfaces **1211** so as to cross the mounting surface **1214** and the insulation surfaces **1211**, thereby covering inside of the mounter **120**.

The cover surface **1212** has a recess structure concaved from one side edge to inside of the insulation surface **1211**. One end of the lug **111** is disposed to contact the recessed cover surface **1212**.

A plurality of slits **1212***b* are formed in the recess structure of the cover surface **1212**, with intervals therebetween. The plurality of slits **1212***b* serve as vents between inside and outside of the mounter body **121**.

The cover surface **1212** is provided with an opening **1212***a* communicated with inside of the mounter body **121**. Through the opening **1212***a*, the external terminal **107***a*, **107***b* can be inserted into the mounter body **121**.

The cover surface **1212** may be provided with an insulation distance extension portion **1213** protruding along a circumference of the opening **1212***a*. Thus, an insufficient insulation distance can be compensated more than in the prior art.

The insulation distance extension portion **1213** is arranged in parallel to the insulation surfaces **1211**, or is arranged on the same plane as the insulation surfaces **1211** (i.e., is arranged in parallel to side surfaces of the case **100** for each phase). As the insulation distance extension portion **1213** is interposed between the terminal connectors **110** which are spaced from each other in a side direction of the case **100**, a short-circuit between phases due to arc gas can be prevented.

Differences between the conventional cited references and the present invention will be explained in more detail.

In the present invention, an insulation distance indicates a distance for preventing a short-circuit occurring between the terminal connector **110** and an external terminal for each phase. The insulation distance is formed by the sum between a spatial distance and a creepage distance.

FIG. **11** is a schematic diagram for explaining a term of 'insulation distance' between a terminal connector and a barrier according to the present invention.

Referring to FIG. **11**, the spatial distance indicates a distance between one terminal connector (C) and another terminal connector (C), which is 'a+b+c'. The creepage distance indicates a distance from one terminal connector (C) and another terminal connector (C) measured along the surface of a barrier (B), which is '2d+2e+b'. Herein, 'a' and 'c' denote straight-line distances from an upper edge of the terminal connector C to an upper edge of the barrier B. 'b' denotes a thickness of the barrier B, 'd' denotes a shortest distance between the terminal connector C and the barrier B, and 'e' denotes a height of the barrier B.

In the conventional cited reference D1, the terminal barrier B (mould) and the terminal connector C (lug) have an interval therebetween (spatial distance: a+b+c). Under such configuration, the spatial distance between the terminal connector (C) and the terminal barrier (B) can be increased, and thus an insulation distance can be obtained.

However, in the present invention, a height (h) of the insulation distance extension portion, a barrier disposed between the terminal connectors **110** adjacent to each other is increased. Thus, the creepage distance is increased than the spatial distance, thereby obtaining an insulation distance.

That is, in the present invention, a spatial distance between the insulation surface **1211** and the terminal connector **110** is reduced. However, a height of the insulation surface **1211** which is disposed between the terminal connectors **110** is increased by the insulation distance extension portion **1213**. This can increase a creepage distance, and thus can satisfy a standard of an insulation distance.

The shielding unit **122** may include mounting surface connection portions **1221** extending toward a bottom surface of the case **100** from a bottom surface of the mounting surface **1214**, and spaced from each other in a side direction; and a

supporting portion **1222** for connecting end portions of the mounting surface connection portions **1221** thereto.

The mounting surface connection portion **1221** and the supporting portion **1222** have a plate structure, and are disposed to be perpendicular to each other.

A fitting recess is formed between the mounting surface **1214** and the supporting portion **1222**, toward outside of the mounting surface connection portion **1221**. The vent chute **105** of the terminal portion **103** is inserted into the fitting recess. Under such configuration, the mounter **120** is inserted into the insertion recess of the terminal portion **103** in a sliding manner.

A locking protrusion **1222***a* is formed at the supporting portion **1222**, and a locking recess **105***a* is formed at a bottom surface of the vent chute **105** in correspondence to the locking protrusion **1222***a*. As the locking protrusion **1222***a* and the locking recess **105***a* are engaged with each other, a coupled state of the mounter **120** to the case can be maintained.

The mounting surface connection portion **1221** of the shielding unit **122** obtains a phase-to-ground insulation distance between the terminal plate **112** and a rear surface of the case **100**, thereby preventing a short circuit between ground and the terminal plate **112**, a current carrying part.

In the present invention, the mounter **120** having the terminal connector **110** can be stably mounted to the terminal portion **103** of the case. Under such configuration, a creepage distance of the barrier becomes longer than a spatial distance between the barrier and the terminal connector **110**. As a result, a phase-to-phase insulation distance set by a standard can be obtained.

Further, the terminal connector **110** can be fixed to the terminal portion more stably, with various structures thereof.

The foregoing embodiments and advantages are merely exemplary and are not to be considered as limiting the present disclosure. The present teachings can be readily applied to other types of apparatuses. This description is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art. The features, structures, methods, and other characteristics of the exemplary embodiments described herein may be combined in various ways to obtain additional and/or alternative exemplary embodiments.

As the present features may be embodied in several forms without departing from the characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be considered broadly within its scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are therefore intended to be embraced by the appended claims.

What is claimed is:

1. A molded case circuit breaker, comprising:

a case;

a power side terminal portion and a load side terminal portion formed at two sides of the case;

a mounter installed at the terminal portion with a structure to enclose a terminal connector connected to the terminal portion,

wherein the mounter includes:

a mounting surface for mounting the terminal connector;

insulation surfaces extending from two side edges of the mounting surface, and spaced from each other, wherein the terminal connector is placed between the insulation surfaces;

a cover surface having an opening, and connecting rear portions of the insulation surfaces so as to cross the insulation surfaces and the mounting surface and cover space between the insulation surfaces, and

an insulation distance extension portion protruding from a rear surface of the cover surface in a direction that the terminal connector is inserted into the mounting surface.

2. The molded case circuit breaker of claim **1**, wherein the terminal connector is a terminal plate having a coupling hole therein, and having a plate structure, and

wherein the terminal plate comes in contact with the mounting surface.

3. The molded case circuit breaker of claim **1**, wherein the mounter includes:

a recess portion concaved from the cover surface toward inside of the insulation surface; and

slits penetratingly-formed at the recess portion.

4. The molded case circuit breaker of claim **1**, wherein the mounter is detachably assembled into the terminal portion provided in the form of an insertion recess.

5. The molded case circuit breaker of claim **1**, wherein the mounting surface is provided with a separation prevention member having a locking protrusion at one end thereof, and

wherein one side of the terminal connector is fixed to the mounting surface by being locked by the locking protrusion.

6. The molded case circuit breaker of claim **1**, wherein the insulation distance extension portion extends from the cover surface in parallel to the insulation surface.

7. The molded case circuit breaker of claim **6**, wherein the insulation distance extension portion is protruding along an edge of the opening.

8. The molded case circuit breaker of claim **1**, wherein the terminal connector includes:

a lug having a box structure, and provided with a cavity therein such that an external terminal is inserted thereinto; and

a coupling member inserted into one surface of the lug, and configured to fix the external terminal,

wherein the insulation surface is formed to contact two side surfaces of the lug.

9. The molded case circuit breaker of claim **8**, wherein the lug is provided with an external terminal fitting portion having a structure to enclose the external terminal.

10. The molded case circuit breaker of claim **1**, wherein the mounter includes a shielding unit extending from the mounting surface toward a rear surface of the case, and configured to obtain a phase-to-ground insulation distance.

11. The molded case circuit breaker of claim **10**, wherein the shielding unit includes:

a mounting surface connection portion vertically extending from the mounting surface toward a rear surface of the case; and

a supporting portion spaced from the mounting surface, and configured to support the mounting surface connection portion.

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